

A NEW SPECIES OF *DASYHELEA* MIDGE REARED FROM
DRAINS IN SINGAPORE (DIPTERA: CERATOPOGONIDAE)

K. M. LEE, W. W. WIRTH, AND K. L. CHAN

(KML, KLC) Department of Zoology, National University of Singapore, Lower Kent Ridge Road, Singapore 0511; (WWW) Systematic Entomology Laboratory, USDA, and Florida State Collection of Arthropods, 1304 NW 94th St., Gainesville, Florida 32606.

Abstract.—Male and female adults, pupae and larvae of *Dasyhelea schizothrxi* new species are described from material collected from free-flowing open-channel concrete drains in Singapore. Diagnostic characters are given to distinguish *D. perfida*, *D. laeta*, and *D. bullocki* from the new species.

Key Words: *Dasyhelea schizothrxi*, open concrete drains, *Schizothrix* algae

Biting midges of the genus *Dasyhelea* Kieffer are common and widespread in all regions of the world. The aquatic or semi-aquatic larvae are found in various habitats that have at least a thin film of water in which the larvae can survive. The larvae are poor swimmers and slowly climb or push through the substratum by using their mouthparts and posterior anal hooks. Their preferred habitats include wet moss or algae along the shores of streams, lakes, ponds, puddles and other water bodies, or wet rotting plant materials such as sap from trees, wet bark, and tree holes. Some species inhabit rock pools, hot springs, or water with high mineral content. Others have colonized the intertidal zone along algae-covered rocks or algae growing on mud exposed to tidal action in salt marshes.

Adult *Dasyhelea* midges are usually found near breeding sites. Shrubs, plants near water, and flowers are favorite resting places of some species. Their feeding habits are little known but some have been found feeding on nectar from flowers and extrafloral nectaries, honeydew, and sweet secretions from plants (Downes and Wirth 1981). None

are known to be bloodsuckers. Some species are important pollinators of *Theobroma cacao*, *Hevea brasiliensis*, and other tropical tree crops.

This is the first record of a *Dasyhelea* from free-flowing open-channel concrete drains in a city. The drainage system was implemented for the control of Anopheline mosquitoes through the removal of all surface water larval habitats. The midge larvae were found living in *Schizothrix* algal beds growing on these drains.

Eggs, larvae, and pupae were collected from the drains by removing a portion of the *Schizothrix* algal bed with a blunt scalpel. Larvae and pupae were killed in hot water and preserved in 70 percent ethanol. Egg masses were allowed to hatch and the larvae were individually reared through to adulthood in the laboratory. Twenty-four hours after emergence, the adults were killed by immersion in 70 percent ethanol, and transferred to glass microvials with the pupal exuviae for storage in 70 percent ethanol. Adults were dissected and mounted on slides according to the methods of Wirth and Marston (1968) and Lee and Chan

(1985). Terminology follows that given by Waugh and Wirth (1976) and Downes and Wirth (1981).

Dasyhelea schizothruxi Lee and Wirth,

NEW SPECIES

Figs. 1-13

Male holotype.—Wing length 1.06 mm; breadth 0.37 mm; costal ratio 0.50.

Head.—Brownish, proboscis and palpi stramineous. Eyes with fine pubescence. Antenna (Fig. 1) with lengths of flagellar segments in proportion of 40-30-30-28-27-25-25-25-52-55-50-82, antennal ratio (segments 12-15/3-11) 0.98; proximal segments not fused; with dense long brown plume setae; segment 12 binodose, 13 slightly so, 15 with long terminal papilla; all segments sculptured. Palpus (Fig. 2) moderately stout, with 14 club-shaped sensilla; lengths of segments in proportion of 28-38-23-25; palpal ratio 1.5.

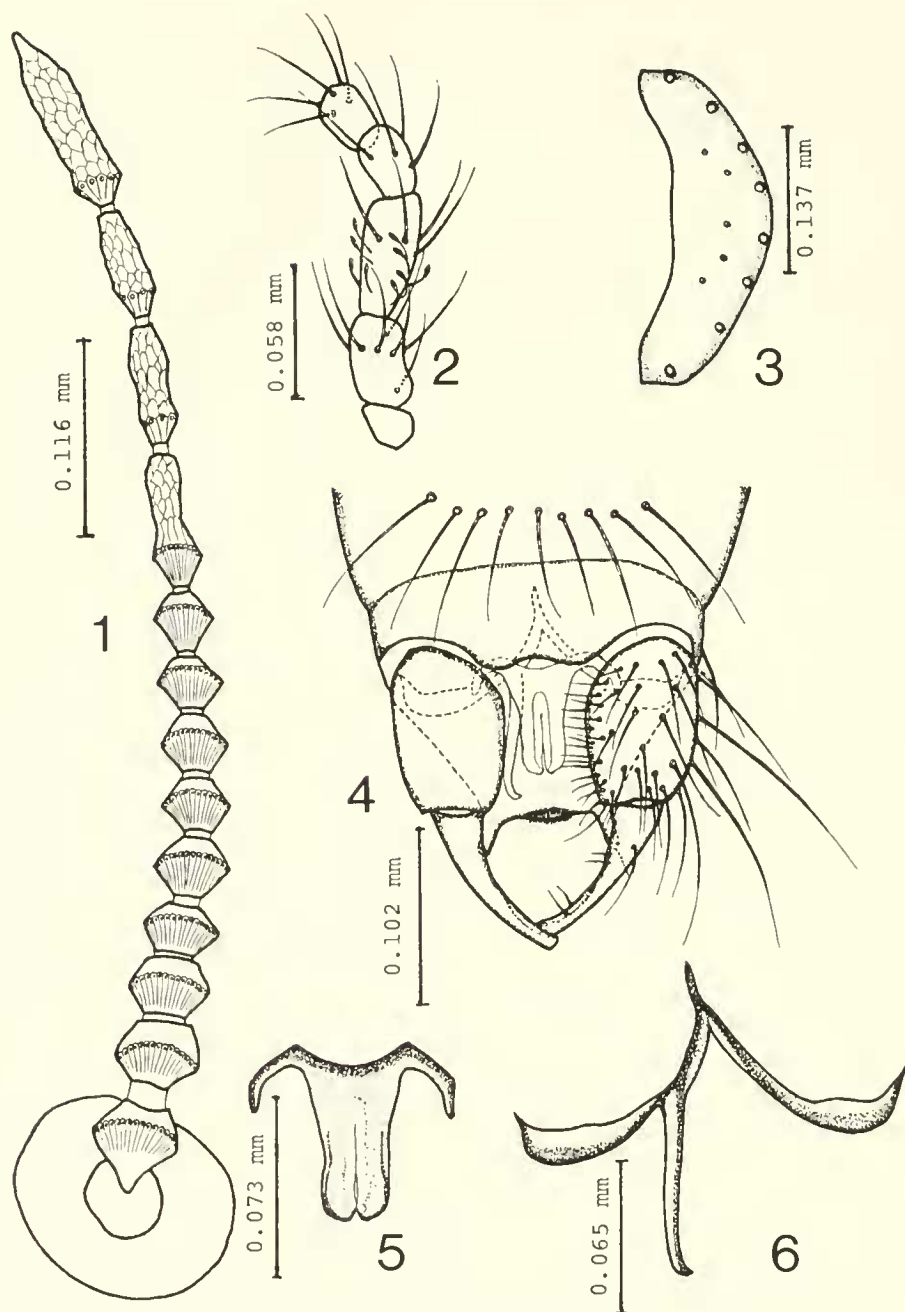
Thorax.—Brownish; two pale longitudinal lines following the well-defined double series of dorsocentral setae; double line of acrostichal setae well defined, lateral setae scattered. Scutellum (Fig. 3) with eight large marginal setae and five smaller ones on disc. Legs stramineous, knee spots blackish; femora with narrow, faintly brownish bands just past midlength, fore tibia with a faint brown band at midlength and narrow brown apex; sparse vestiture of slender setae; tibiae with bristly setae; fifth tarsomeres brownish. Wing membrane whitish, radial veins slightly infuscated; first radial cell not formed, second radial cell faintly indicated by obscure thickening of veins, apex of cell truncated; macrotrichia long and slender, decumbent, moderately sparse, forming rows along veins and on membrane on proximal 0.7 of wing; bare lines between rows of macrotrichia. Halter deeply infuscated.

Abdomen.—Brown without segmental bands; sparse vestiture of long slender brown setae in transverse rows. Genitalia (Fig. 4): Ninth sternum slightly broader and slightly

bilobate in midportion; ninth tergum slightly broader than long, markedly tapering distally to a pair of well-developed apicolateral processes. Gonocoxite slightly bulbous, stout, about 1.5 times longer than broad, without mesal hooklike process; gonostylus slightly longer than gonocoxite, stout proximad, tapering at midportion to slender, slightly arcuate, blunt-tipped distal portion. Aedeagus (Fig. 5) dark brown, slightly broader at base than total length, bearing a narrow bisinuate transverse sclerite proximally and a pair of elongate, pillar-like submedian processes caudally with bases narrowly joined and with a transparent membrane between except at extreme apex. Parameres (Fig. 6) heavily sclerotized, brownish, asymmetrical; basal apodemes unusually slender, the posterior process also slender in its entire length, slightly curved, extending caudad nearly to tip of ninth tergum.

Female allotype.—Wing length 1.00 mm; breadth 0.44 mm; costal ratio 0.56.

Similar to male with usual sexual differences. Antenna (Fig. 7) with lengths of flagellar segments in proportion of 34-30-30-30-30-30-30-32-34-35-35-60, antennal ratio (11-15/3-10) 0.80; segments ovoid, slightly attenuated distally; last segment with long terminal nipple as in male; all segments with definite sculpturing. Palpus (Fig. 8) stouter than in male, with 17 club-shaped sensilla; lengths of segments in proportion of 16-36-17-24, palpal ratio 1.4. Scutellum (Fig. 9) with nine large marginal setae and six smaller ones on disc. Wing with membrane dusky and veins more brownish than in male, second radial cell with oblique apex; macrotrichia slightly more numerous than in male, shorter and stiffer. Abdomen brownish, especially on pleural membrane which is dark brown and shagreened; setae scattered and dense on pleura. Genital sclerotization (Fig. 10) characteristic of the *grisea* species group with sinuate caudolateral arms on each side of gonopore and evenly tapering anteromedian lobe. Spermatheca

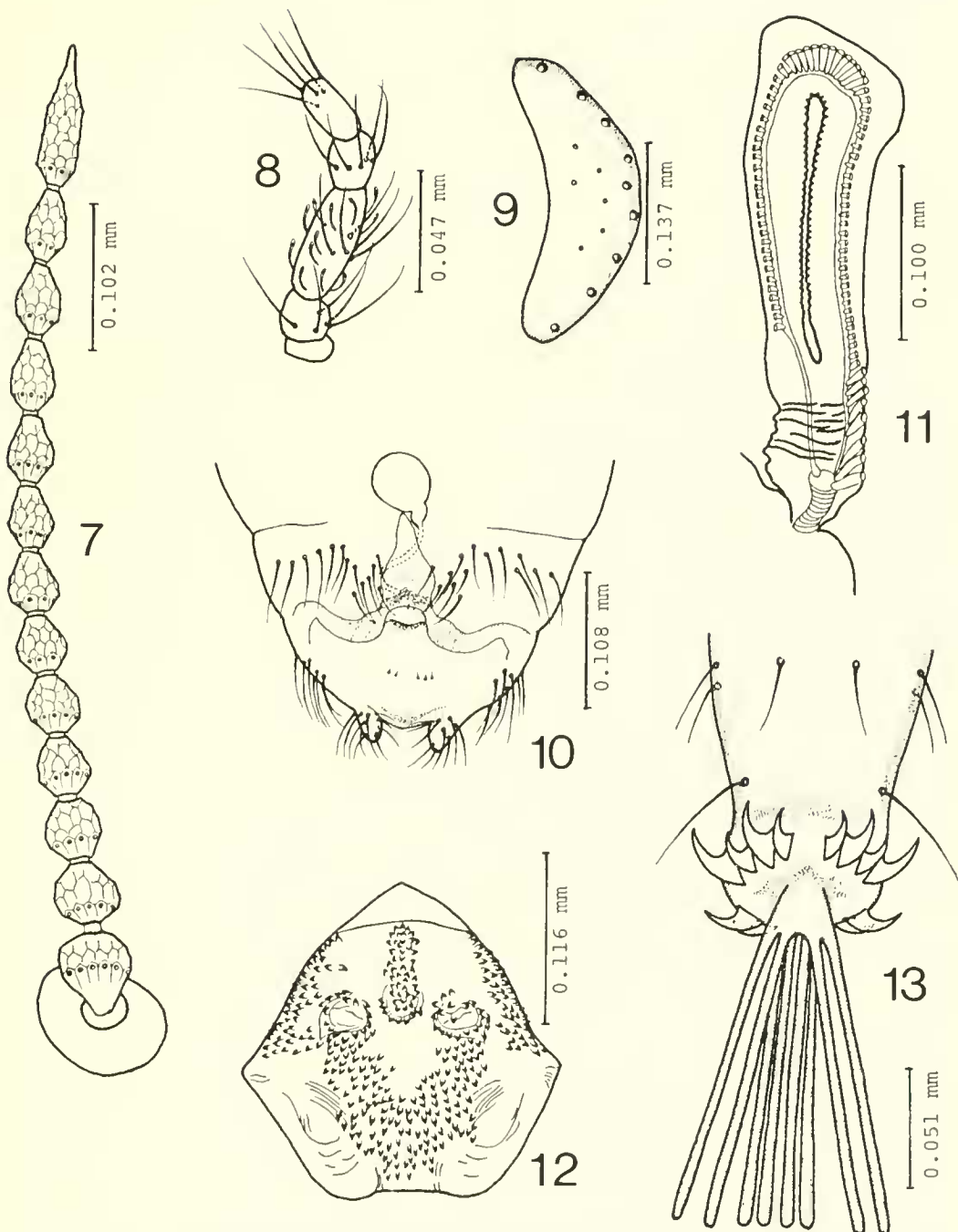


Figs. 1-6. *Dasyhelea schizothrivi* (male): 1, antenna; 2, palpus; 3, scutellum; 4, genitalia, ventral view; 5, aedeagus; 6, parameres.

single, pyriform with neck tapering and slightly oblique; measuring 0.072 by 0.055 mm including neck portion.

Pupa.—Length 2.06 mm. Dorsum of

cephalothorax dark brown; degree of pigmentation on abdomen fainter posteriorly. Integument shagreened with minute tubercles that are coarse and thornlike on cep-



Figs. 7-13. *Dasyhelea schizothrix*; 7-10, female; 11-12, pupa; 13, larva; 7, antenna; 8, palpus; 9, scutellum; 10, genitalia, ventral view; 11, respiratory horn; 12, operculum; 13, last abdominal segment, ventro-posterior view.

alothorax, particularly on operculum (Fig. 12); setae poorly developed. Respiratory horn (Fig. 11) 0.30 mm long, transversely ridged, marginally expanded and slightly curved distally; outer edge of base with eight large spiracles; 67 (60–72) small spiracles form a dorsal loop near margin of respiratory horn; dorsal slit 0.16 mm long. Abdominal segments each with a ring of low scale-like tubercles near posterior margin, most of these tubercles with a minute transparent seta. Last abdominal segment with two dorsal and two ventral lobes; dorsal lobe with large dorsal spine and lateral spine; ventral lobe stout and blunt in female but tapering posteriorly in male pupa.

Larva.—Length 4.70 mm in fourth instar. Head capsule dark brown with two conspicuous black pigment spots; body milky except for slight brown pigmentation on dorsum. Head and body setae inconspicuous, few. A pair of distinct, internal, brownish pigment spots in each of the first two thoracic segments. Terminal abdominal segment (Fig. 13) with two pairs of slender hooks dorsally, four pairs of slender hooks ventrally; each pair of hooks consists of one small and one large hook; a band of slender spicules immediately anterior to hooks. Rectal gills grouped into two pairs dorsally and two pairs ventrally.

Distribution.—Singapore.

Types.—Holotype male, allotype female; Kent Ridge, Singapore, 2.x.1985, K. M. Lee, reared from concrete drains with *Schizothrix* algae. Paratypes: 9 males, 7 females, 4 larvae, 10 pupae, same data, but dates 16.v–8.ix.1984. Holotype and allotype specimens are deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D.C. Paratypes are deposited in the Australian National Collection, Canberra; B. P. Bishop Museum, Honolulu, Hawaii; British Museum (Natural History), London; Museum National d'Histoire Naturelle, Paris; and Zoological Reference Collection, National University of Singapore, Singapore.

Discussion.—*Dasyhelea schizothrxi* belongs to a large group of closely related species that characteristically breed in rock holes or in drains, roof gutters, or similar habitats. The group includes *D. carolinensis* Tokunaga (1941) from the Caroline Islands, *D. hitchcocki* Wirth (1976) from the Tonga Islands and Samoa, *D. laeta* (Johannsen) (1931) from Sumatra, *D. perfida* (Johannsen) (1931) from East Java, *D. pseudoinsurata* Waugh and Wirth (1976) from the southeastern United States, *D. saxicola* Edwards (1929) [synonym *D. lithotelmatica* Strenzke (1956)] from Europe, *D. sublettei* Wirth (1987) from the southwestern United States, *D. thompsoni* de Meillon (1936) from Transvaal, *D. tugelae* de Meillon (1936) from Natal, and *D. upsilon* de Meillon and Wirth (1987) from Transvaal.

According to its incomplete original description, *Dasyhelea perfida*, described from water-sprayed leaves of *Colocasia indica* near a waterfall, closely resembles *D. schizothrxi*. *Dasyhelea perfida* has a yellowish thorax with brownish vittae; yellow unbanded legs; body length of 1.2 mm, and a whitish halter with darker stem. The female has large brownish spots on the intermediate pleura of the abdomen. The male genitalia are nearly identical with those of the new species except that the ninth sternum is not bilobed and the posterior process of the parameres is distinctly bent backwards at the tip. According to Mayer (1934) the pupal respiratory horn of *D. perfida* differs from that of *D. schizothrxi* in having a loop of 49 spiracles around the margin of the distal half (similar in arrangement to many species of the genus) and eight spiracular openings on the transversely ridged basal portion.

Tokunaga and Murachi (1959) apparently incorrectly redescribed *Dasyhelea perfida* from misidentified Micronesian material. Their species differs from *D. perfida* in the male genitalia: the apicolateral processes on the ninth tergum are blunt; the aedeagus has four distinct posterior processes, and the

posterior process of the parameres is broadly expanded distally and has a blunt distal point.

Dasyhelea laeta, reared from rock pools in Sumatra, differs from *S. schizothruxi* in its larger size (male body 2 mm, female 1.75 mm); in its shining dark brown mesonotum with four darker brown vittae; in its pale halteres, and in its brownish legs with under sides of the femora yellowish and the tips of the femora with preapical whitish rings. In *D. laeta*, the pupal respiratory horn has coarse scales on most of the midportion, 10 spiracles in a loop at the extreme tip, and five widely spaced spiracles on the basal portion.

Dasyhelea bullocki, from a rock hole near a stream in Korea, belongs to the same group as the new species, but differs in its more distally attenuated antennal segments; in its spermatheca with elongate oblique neck; in its male genitalia with a stout, tapering, posterior process on the parameres, and in its single loop of spiracular openings on the pupal respiratory horn.

Five closely related species that breed in the pitchers of *Nepenthes* are more distantly related to this group of species, differing in details of the pupal respiratory horn, male genitalia, and in the more elongate, bent neck of the spermatheca. This group of species includes *D. ampullariae* Macfie (1934) from Malaysia, *D. biseriata* Wirth and Beaver (1979) from Malaysia, *D. confinis* (Johannsen) (1931) from Sumatra, *D. nepenthicola* Wirth and Beaver (1979) from Malaysia, and *D. subgrata* Tokunaga (1961) from West Irian.

LITERATURE CITED

- Downes, J. A. and W. W. Wirth. 1981. Ceratopogonidae, Pp. 393-421. In J. F. McAlpine et al., eds., Manual of Nearctic Diptera, Volume 1. Agric. Canada Monogr. 27. 674 pp.
- Edwards, F. W. 1929. British non-biting midges (Diptera, Chironomidae). Trans. Entomol. Soc. London 77: 279-430.
- Johannsen, O. A. 1931. Ceratopogoninae from the Malayan Subregion of the Dutch East Indies. Arch. Hydrobiol. Suppl. Bd. 9: 403-448, 5 plates.
- Lee, K. M. and K. L. Chan. 1985. The biology of *Dasyhelea ampullariae* in monkey cups at Kent Ridge (Diptera: Ceratopogonidae). J. Singapore Nat. Acad. Sci. 14: 6-14.
- Macfie, J. W. S. 1934. Report on a collection of Ceratopogonidae from Malaya. Ann. Trop. Med. Parasitol. 38: 177-194, 279-293.
- Mayer, K. 1934. Ceratopogoniden-Metamorphosen (C. Intermediae und C. Vermiformes) der Deutschen Limnologischen Sunda-Expedition. Arch. Hydrobiol. Suppl. Bd. 13: 166-202, 6 plates.
- Meillon, B. de. 1936. Entomological studies. Studies on insects of medical importance in South Africa. Part III. South African Ceratopogonidae. Part II. Some new and unrecorded species. Publ. S. Afr. Inst. Med. Res. 7: 141-207.
- Meillon, B. de and W. W. Wirth. 1987. Sub-Saharan Ceratopogonidae (Diptera). XII. New species and records, mainly from South Africa. J. Entomol. Soc. S. Afr. 50: 35-74.
- Strenzke, K. 1950. XI. Anhang. *Dasyhelea lithotelmatica* n. sp., Pp. 178-187. In A. Thienemann, ed., Lunzer Chironomiden. Arch. Hydrobiol. Suppl. Bd. 18: 1-202.
- Tokunaga, M. 1941. Biting ceratopogonid midges from the Caroline Islands. Annot. Zool. Jap. 20: 109-119, 1 plate.
- . 1961. Notes on biting midges II. Kontyu 29: 180-185.
- Tokunaga, M. and E. K. Murachi. 1959. Diptera: Ceratopogonidae. Insects of Micronesia 12: 103-434.
- Waugh, W. T. and W. W. Wirth. 1976. A revision of the genus *Dasyhelea* of the eastern United States north of Florida (Diptera: Ceratopogonidae). Ann. Entomol. Soc. Am. 69: 219-247.
- Wirth, W. W. 1976. A new species and new records of *Dasyhelea* from the Tonga Islands and Samoa (Diptera: Ceratopogonidae). Proc. Hawaiian Entomol. Soc. 22: 381-384.
- . 1987. A new species of *Dasyhelea* (Diptera: Ceratopogonidae) from rock pools in the southwestern United States. J. N. Am. Benthol. Soc. 6: 72-76.
- Wirth, W. W. and R. A. Beaver. 1979. The *Dasyhelea* biting midges living in pitchers of *Nepenthes* in Southeast Asia (Diptera: Ceratopogonidae). Annls. Soc. Entomol. France (N.S.) 15: 41-52.
- Wirth, W. W. and N. Marston. 1968. A method for mounting small insects on microscopic slides in Canada balsam. Ann. Entomol. Soc. Am. 61: 783-784.